Armed Forces College of Medicine

AFCM

Female Reproductive system

Placenta & Mammary glands

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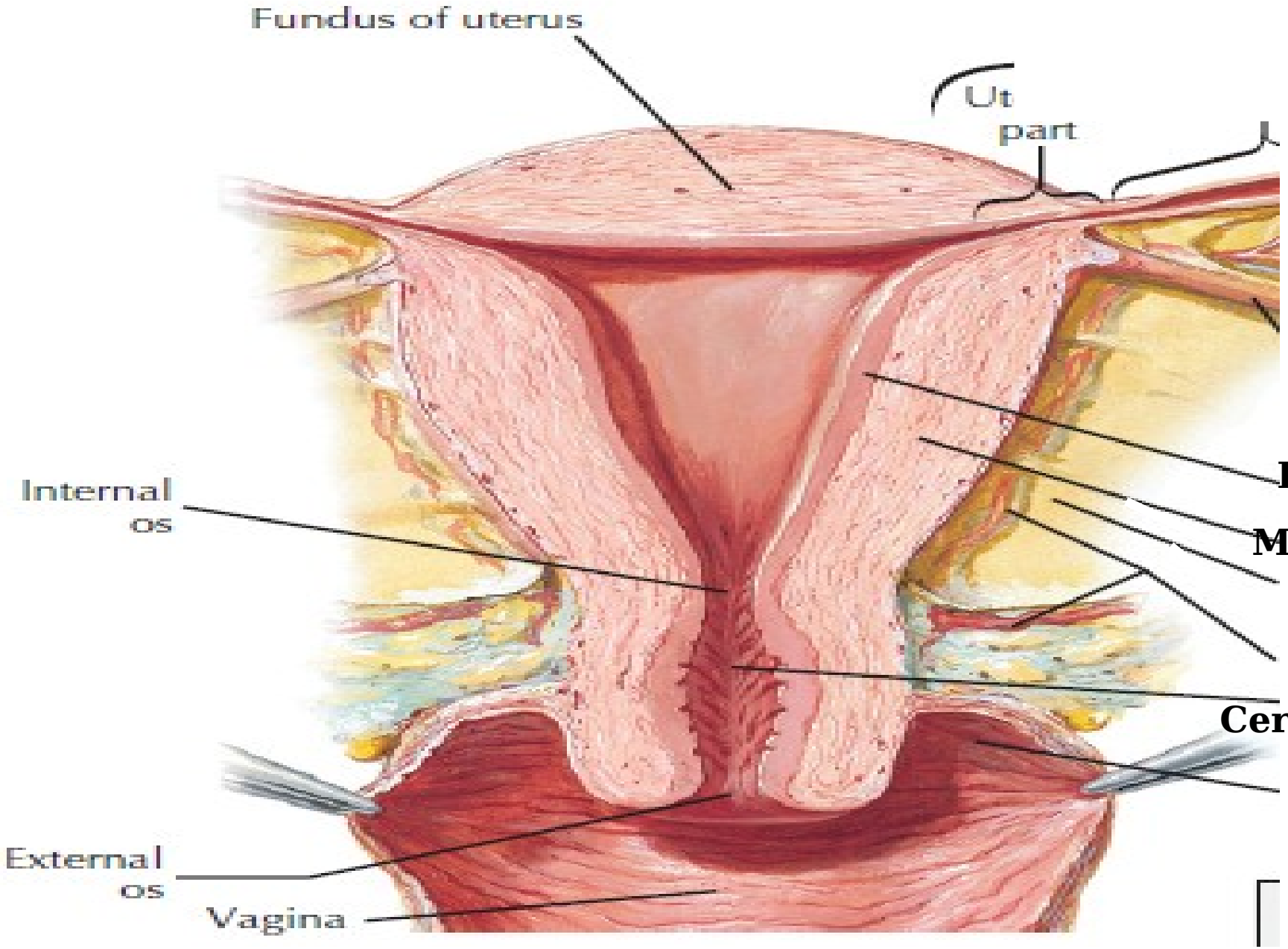
INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

1. Describe the microscopic structure of the placenta.
2. Correlate the microscopic structure of the placenta to its function.
3. Describe the structure of the resting and lactating mammary glands.
4. Analyze the changes in the microscopic structure of the


Fundus of uterus
Ut
part
Internal
os
External
os
Vagina
Endometriu
m
Myometrium
Cervical canal

Cervix of the uterus

- The wall of cervix consists mainly of dense CT with few smooth muscle fibers.

Epithelial lining:

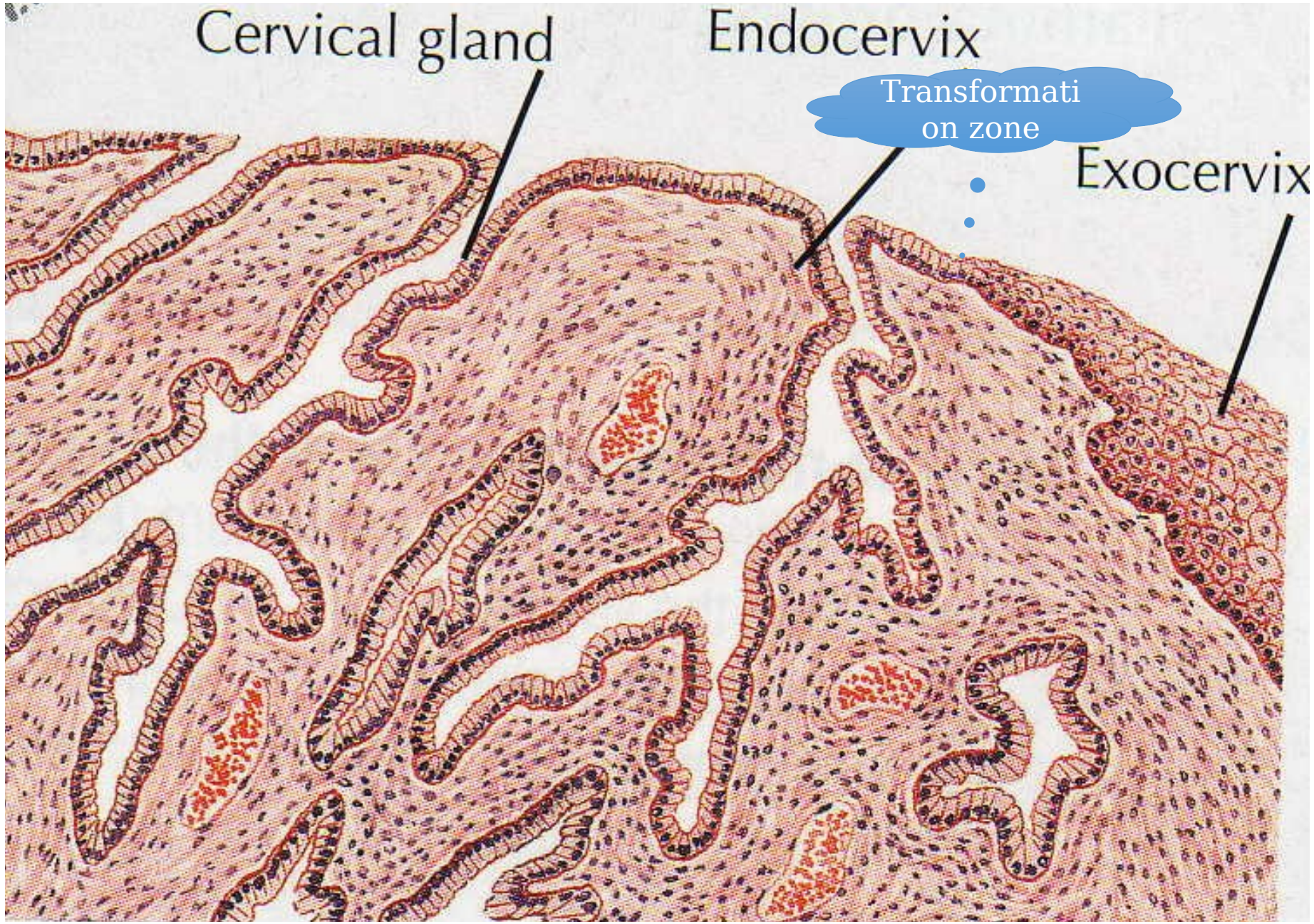
- Simple tall columnar mucous secreting.
- Just above the opening of the cervix (external os) the epithelium abruptly changes to stratified squamous non-keratinizing epithelium.

Lamina propria:

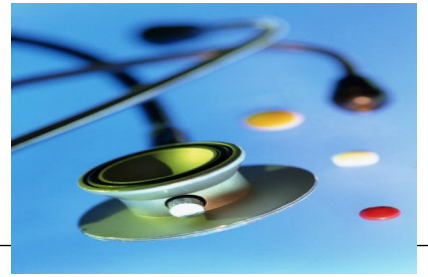
- CT containing branched tubuloalveolar glands secreting mucous.
- The cervix dilates during labour due to the effect of relaxin hormone.

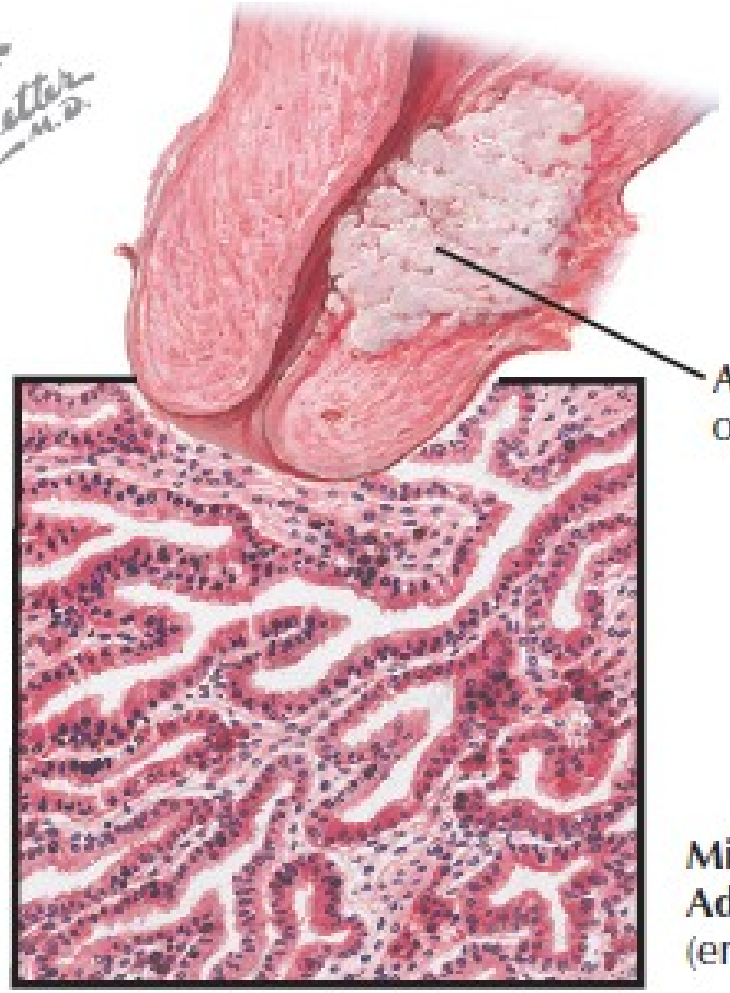
❑Cyclic changes of the cervix:

- The cervical mucosa is not shed during menstruation (WHY?), but cyclic changes occur in the amount and viscosity of the cervical secretion.
- At ovulation (watery), while at pregnancy or luteal phase (viscous→ mucus plug)---- > (WHY?)


Cervical gland
Endocervix
Transformati
on zone
Exocervix

Clinical Correlation
PAP Smear



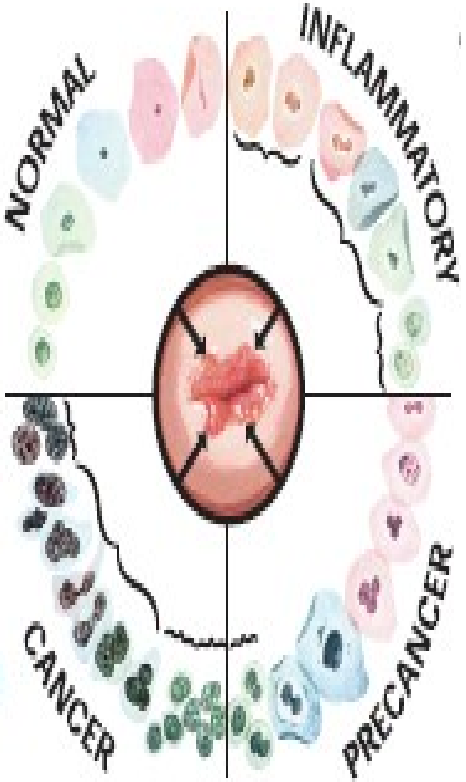


Cervical carcinoma: gross anatomic and microscopic views.

Advanced cancer. With invasion of the muscular wall.

Microscopic section: Adenocarcinoma (endocervical).

Exfoliative cytology of cervical scrapings to determine presence or absence of malignancy.



Cervical cell pathology in squamous tissue: grades and cell types.

Vagina

- **It is a fibro-muscular tube.**
- **Its wall *lacks glands ---- > How is the vagina lubricated?***

A- Mucosa:

- **Epithelium: stratified squamous non-keratinizing rich in:**

  a. Glycogen (so appear vacuolated) → fermented by vaginal bacteria → lactic acid → low pH → prevent bacterial invasion.

  b. Langerhans cells (APCs).

- **Lamina propria: C.T. rich in elastic & collagenous.**

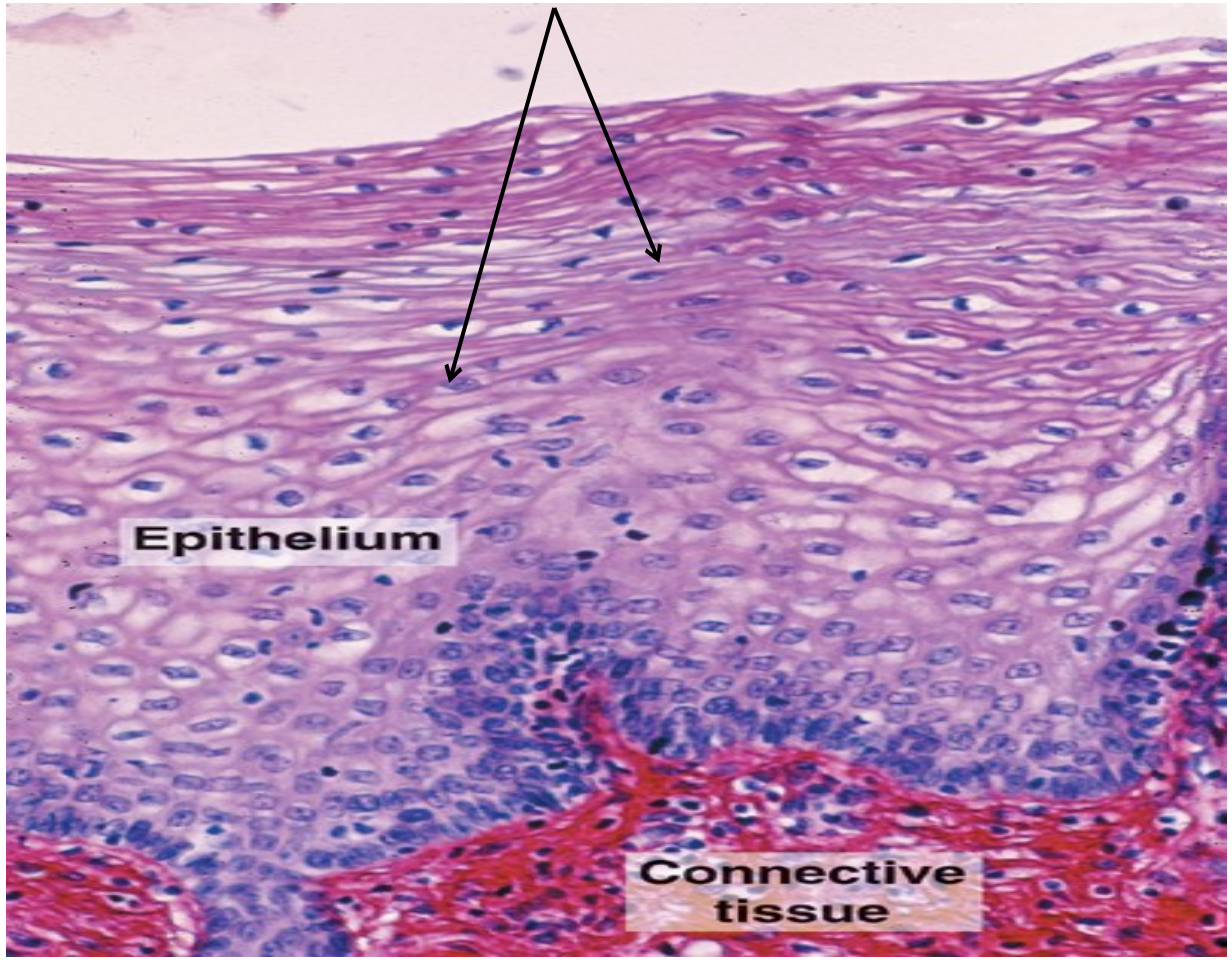
  It contains extensive blood capillaries, lymphocytes and neutrophils.

B- Musculosa: I.C & O.L

C- Adventitia: fibroelastic C.T.

Vagina

:Note
.Vacuolated epith



- ***Cyclic changes of the vagina*:**

1. **Under influence of estrogen:**

- **↑ thickness of epithelium**
- **↑ synthesis and storage of glycogen & lipids**

2. **Under influence of progesterone:**

- **↑ desquamation of superficial cells and release of glycogen into vaginal lumen.**

Did you notice that.....

Estrogen induces proliferation

Progesterone induces secretion

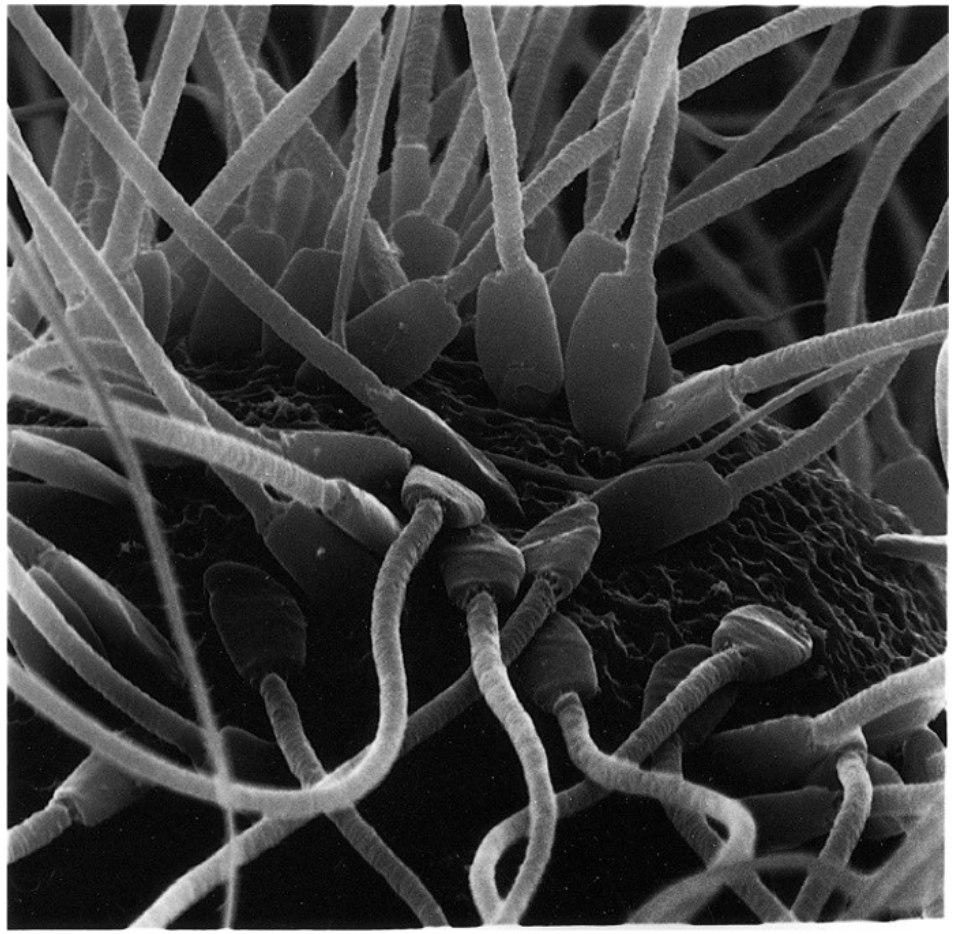
In all organs of female reproductive system

FERTILIZATION

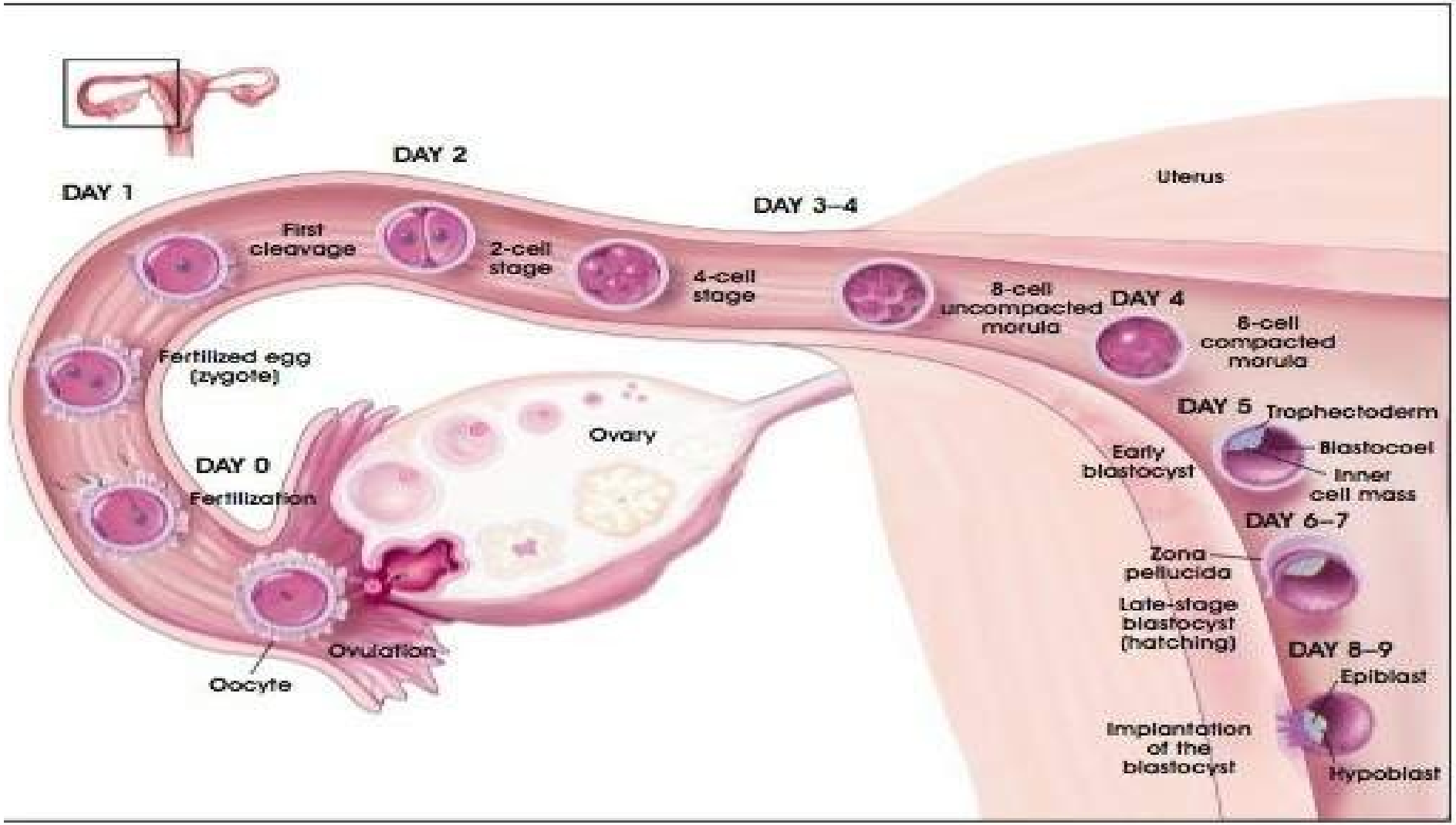
- **Definition** : fusion of sperm and the ovum restoring the diploid chromosome number
- **Site**: ampulla of fallopian tube

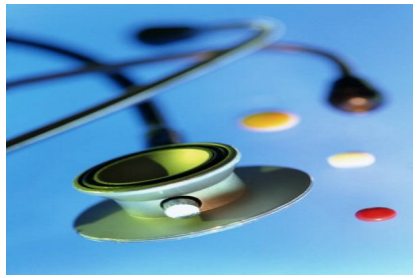
- Fertilization initiate completion of the 2nd meiotic division→ mature ovum and 2nd polar body.
- **Cortical granules →** prevent more than one sperm to enter into the ovum (Polyspermia).

- Zygote → several mitosis **morula.**
- Mitosis continues with cavity appears in the center, now called **blastocyst.**



FERTILIZATION

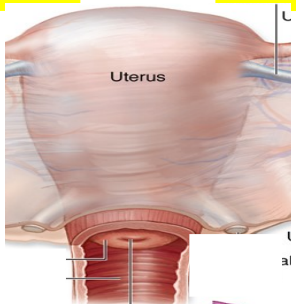




Clinical Correlation
In Vitro Fertilization (IVF)

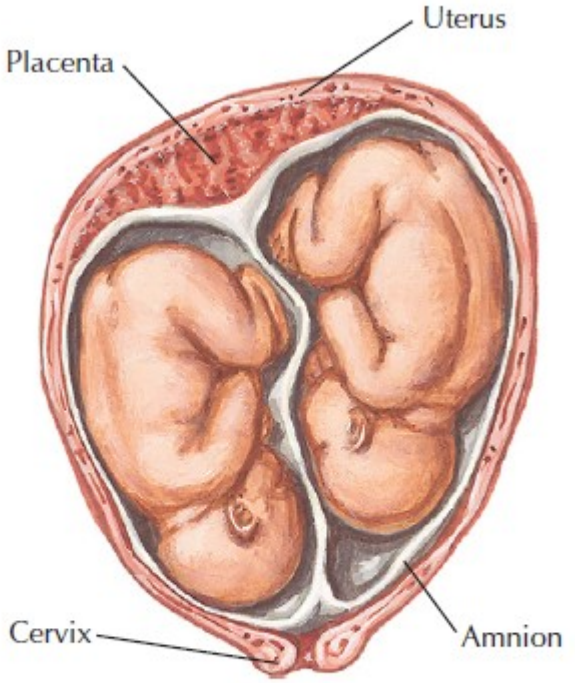
Human fertilized oocyte with 2 pronuclei

48-hour-old embryo consists of 4 cells



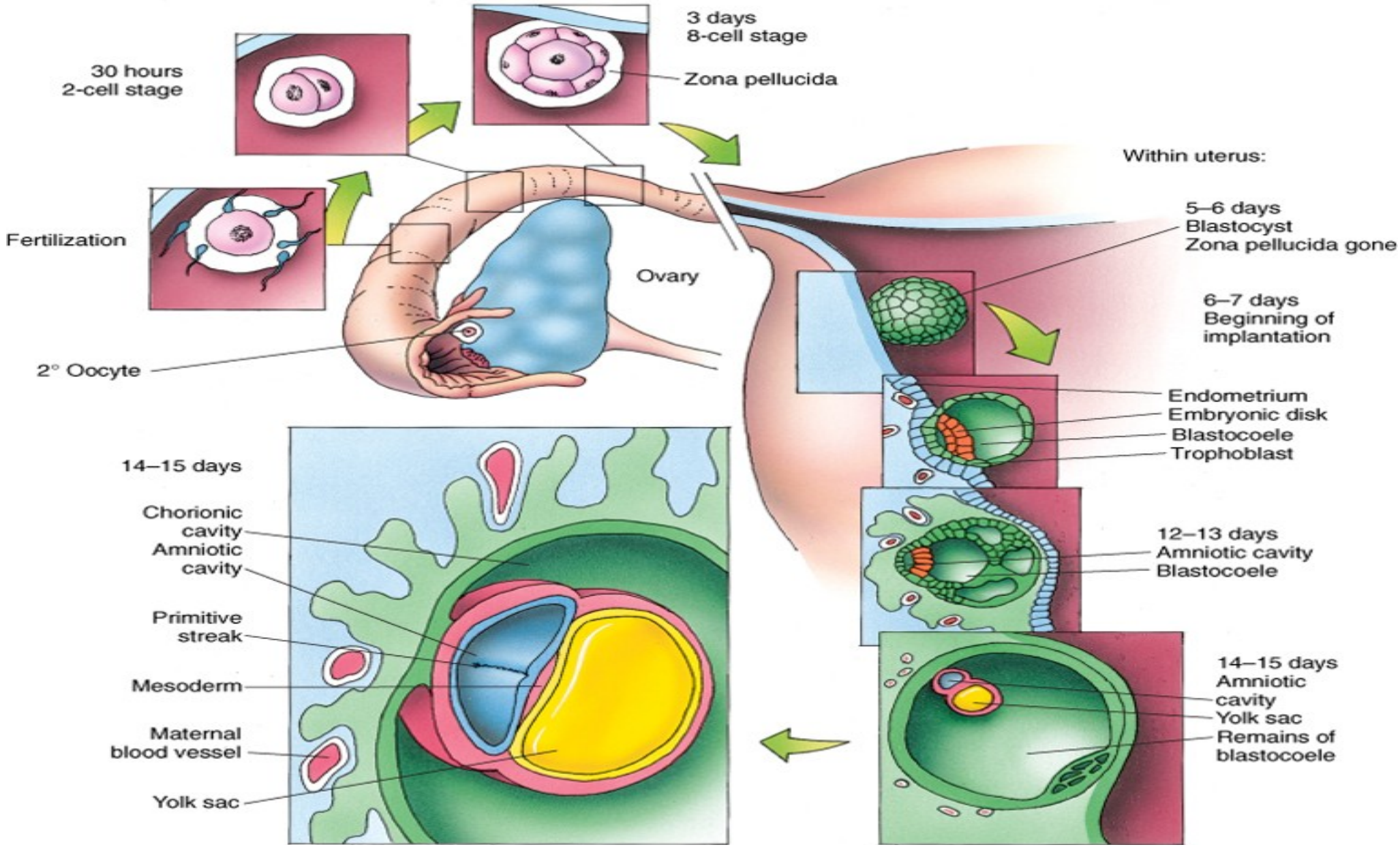
Multiple pregnancies

- **Identical twins → single oocyte splits into 2 zygotes during early development→ share same placenta.**
- **Non-identical twins → 2 oocytes are fertilized by separate 2 sperms → separate placentas.**



▲ Twin fetuses within the uterus.

Fertilization (animation)


30 hours
2-cell stage
3 days
8-cell stage
Zona pellucida
Fertilization
Ovary
2° Oocyte
Within uterus:
5–6 days
Blastocyst
Zona pellucida gone
6–7 days
Beginning of
implantation
Endometrium
Embryonic disk
Blastocoele
Trophoblast
12–13 days
Amniotic cavity
Blastocoele
14–15 days
Amniotic
cavity
Yolk sac
Remains of
blastocoele
14–15 days
Chorionic
cavity
Amniotic
cavity
Primitive
streak
Mesoderm
Maternal
blood vessel
Yolk sac

IMPLANTATION

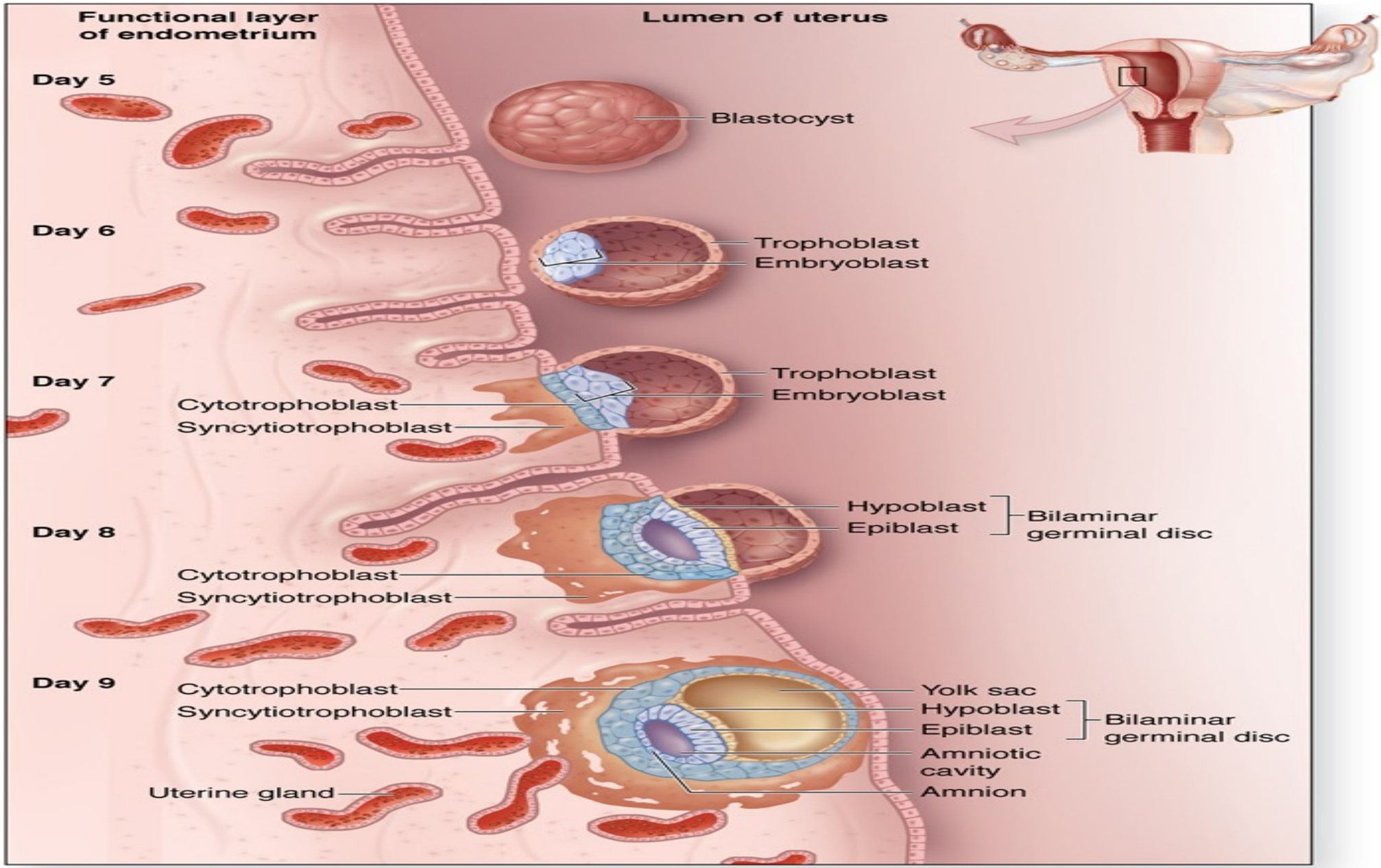
- **The blastocyst enters the uterine cavity→ 4 days after fertilization.**
- **Z.P. disappears (D5)→allowing the trophoblast cell to contact endometrium.**

- **The cells of the blastocyst called <u>blastomeres</u> forms 2 layers:**

1- Peripheral trophoblast forms → the fetal part of the placenta.

2- Disc of cells (inner cell mass) forms → the embryo.

- **Implantation involves the attachment of embryo to the endometrium and its penetration into L.P. → (decidua)**


Functional layer of endometrium
Lumen of uterus
Day 5
Blastocyst
Day 6
Trophoblast
Embryoblast
Day 7
Trophoblast
Embryoblast
Cytotrophoblast
Syncytiotrophoblast
Day 8
Hypoblast
Epiblast
Bilaminar germinal disc
Cytotrophoblast
Syncytiotrophoblast
Day 9
Cytotrophoblast
Syncytiotrophoblast
Yolk sac
Hypoblast
Epiblast
Bilaminar germinal disc
Amniotic cavity
Amnion
Uterine gland

Trophoblasts

The trophoblast cells attach to endometrium (chorionic villi), divide rapidly and differentiate into 2 layers:

1. **Outer layer (syncytiotrophoblast)**

- **LM: consist of multiple nuclei in a single layer of cytoplasm.**
- **EM: abundant rER, little SER, lipid droplet, mitochondria with tubular cristae ----- > Function????**

2. Inner layer (cytotrophoblast) composed of separate cells which is mitotically active.

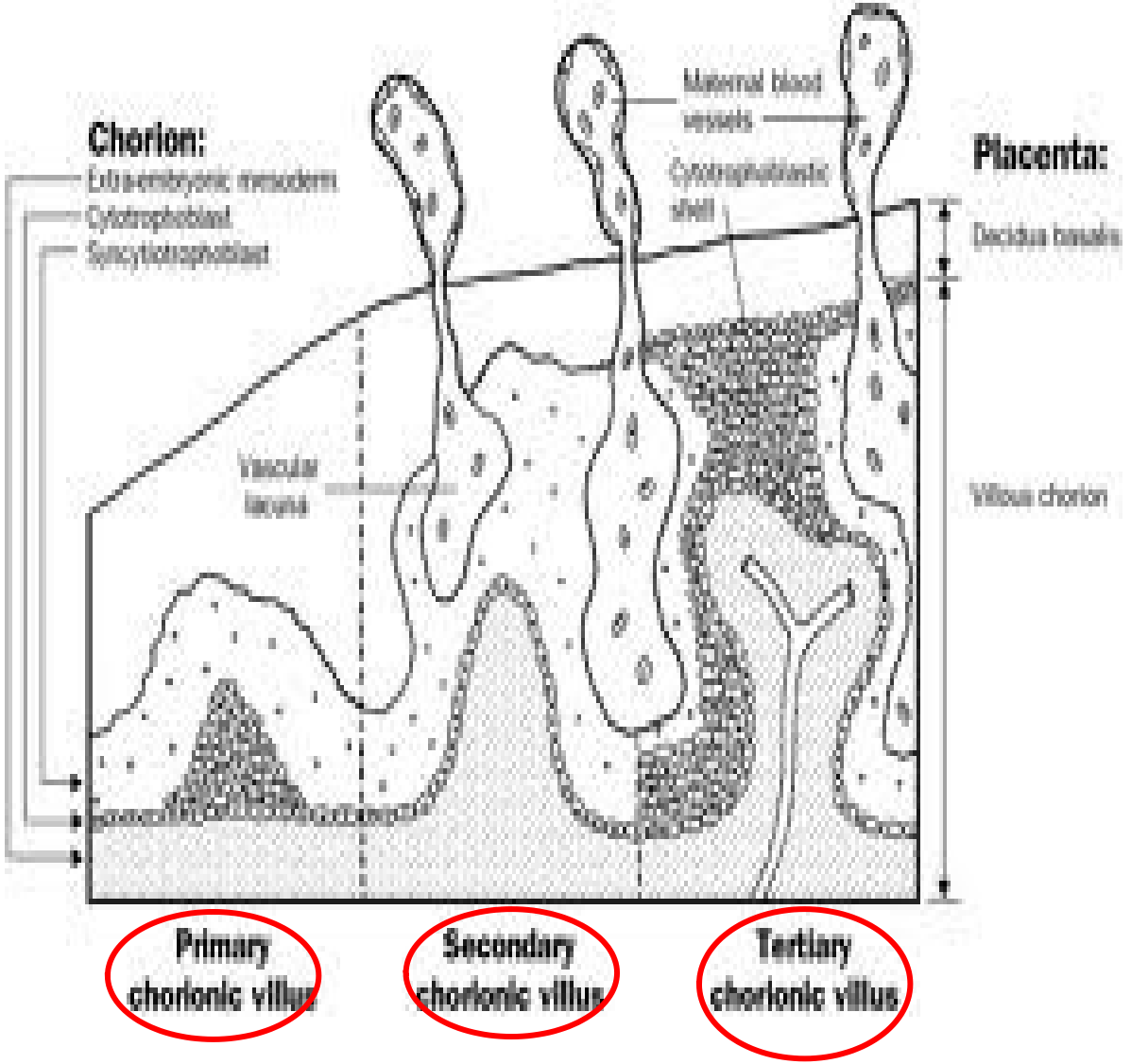
- **LM: cuboidal cells with clear boundaries.**
- **EM: many free ribosomes, mitochondria, little RER & SER ---- > Function????.**
- **After 4th months of pregnancy it disappears.**

➢ **Each villus is formed of a core of mesenchymal CT containing fetal**

Chorionic villi

➢According to their development:

- ***1. Primary villi*** (11th-13th D) → cytotrophoblast + syncytiotrophoblast
- ***2. Secondary villi*** (16th D) → extraembryonic mesenchymal cells enter core of 1ry villi.
- ***3. Tertiary villi*** (3rd W) → extensive fetal bl.v. enter mesenchymal tissue.



Placenta

The placenta consists of foetal and maternal component.

A-Maternal component:

- **Is the decidua basalis (underlying implantation site)**
- **It is characterized by presence of irregular blood spaces (lacunae) and stromal decidual cells.**

B-Foetal component:

- **Is the (chorion), it is formed of chorionic villi (anchoring &free villi).**

- *Functions of placenta:*

1- It is essential for growth of the fetus.

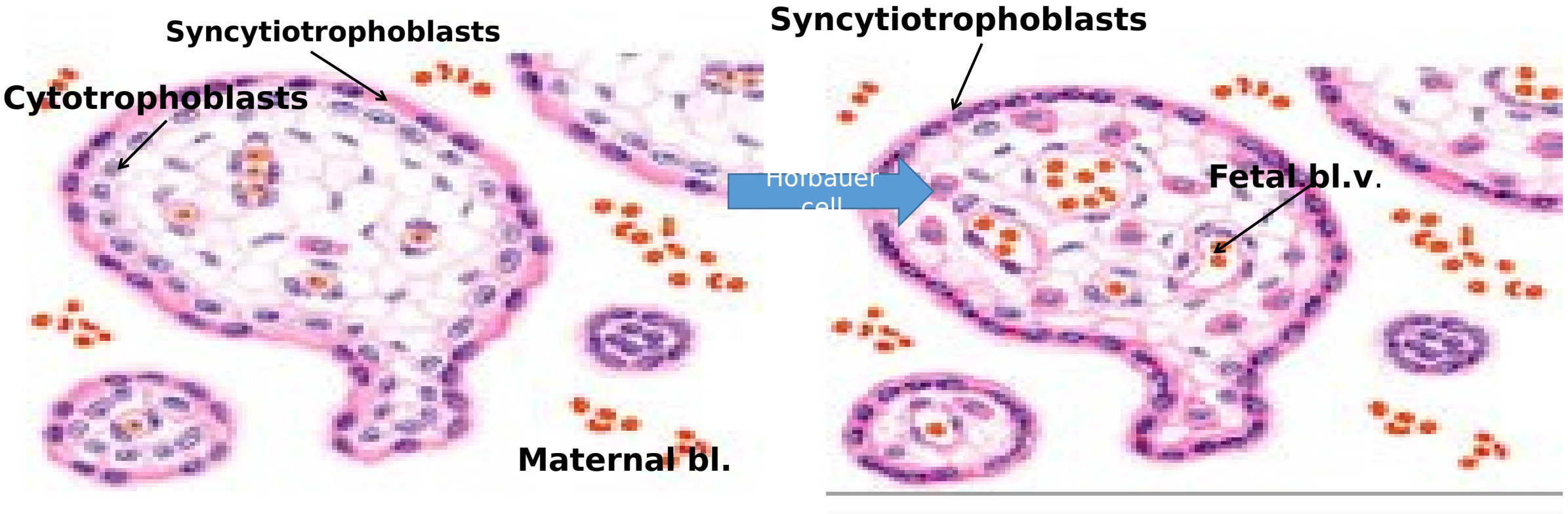
2- It acts as a temporary endocrine gland: HCG, pla… …togen, progesterone, estrogen, leptin, relaxin ----> by syncytiotrophoblast.

3- Placental barrier prevents passage of harmful material to fetus.

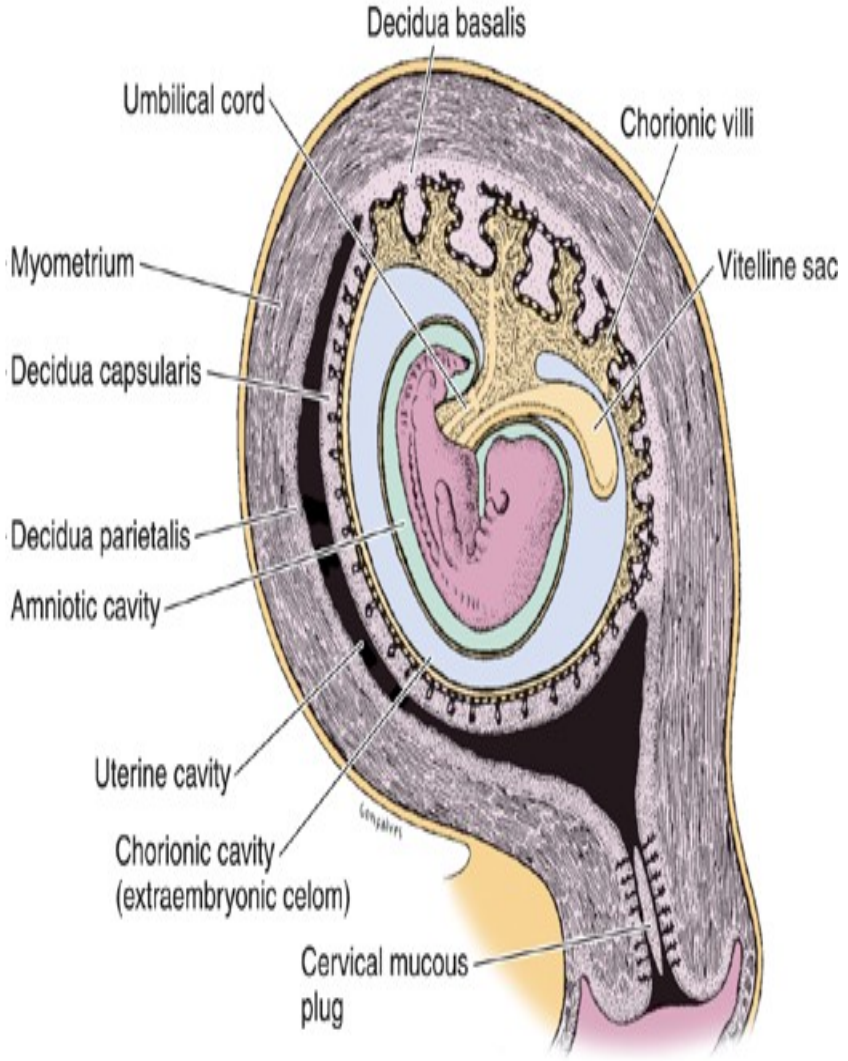
Placenta

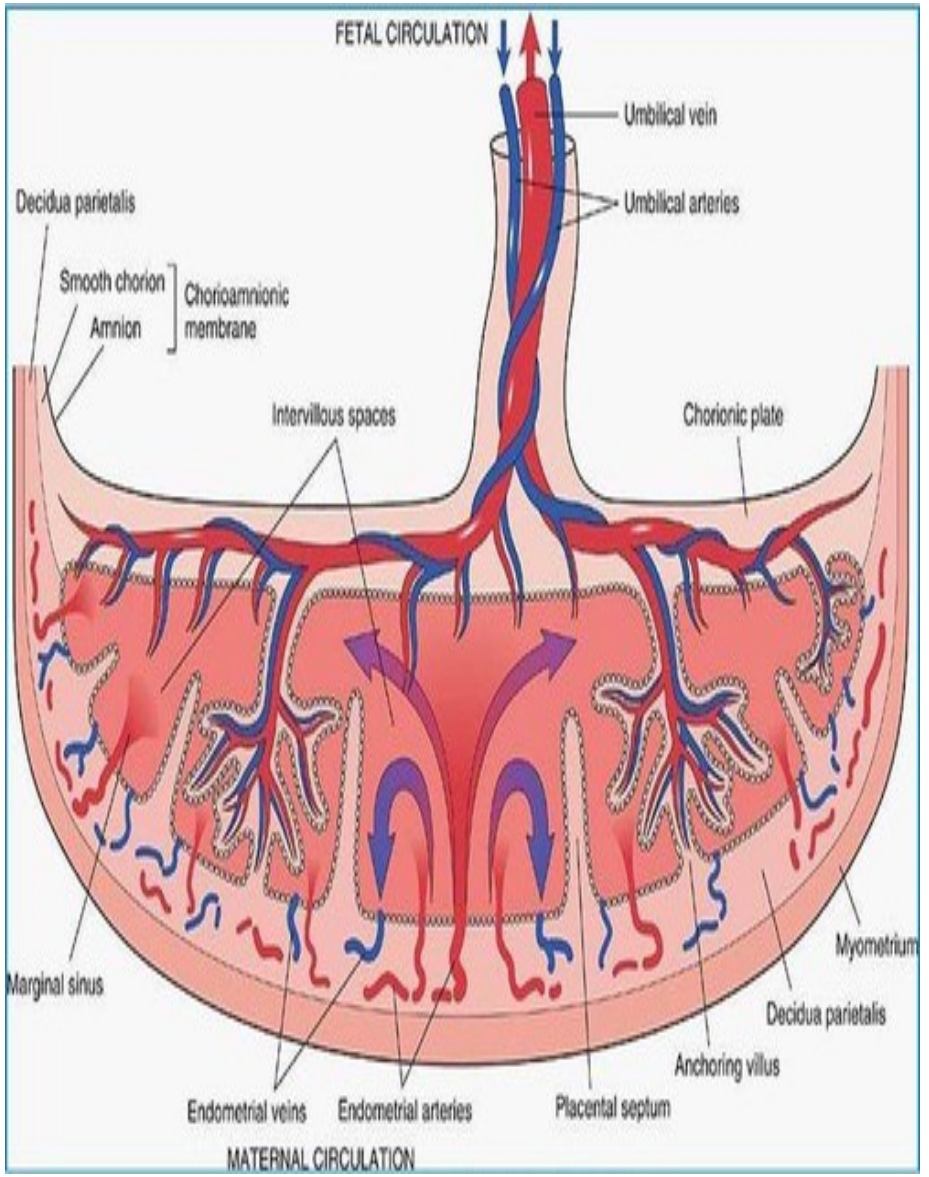
Early in pregnancy

Late in pregnancy



Placenta


Decidua basalis
Umbilical cord
Chorionic villi
Myometrium
Vitelline sac
Decidua capsularis
Decidua parietalis
Amniotic cavity
Uterine cavity
Chorionic cavity
(extraembryonic celom)
Cervical mucous
plug


FETAL CIRCULATION
Umbilical vein
Umbilical arteries
Decidua parietalis
Smooth chorion
Amnion
Chorioamnionic
membrane
Intervillous spaces
Chorionic plate
Myometrium
Marginal sinus
Decidua parietalis
Anchoring villus
Endometrial veins
Endometrial arteries
Placental septum
MATERNAL CIRCULATION

Placental barrier

Is formed of:

1- Syncytiotrophoblast.

2- Cytotrophoblast (till 4th months).

3- B.M. of the trophoblast.

4- Extraemberyonic mesenchyme.

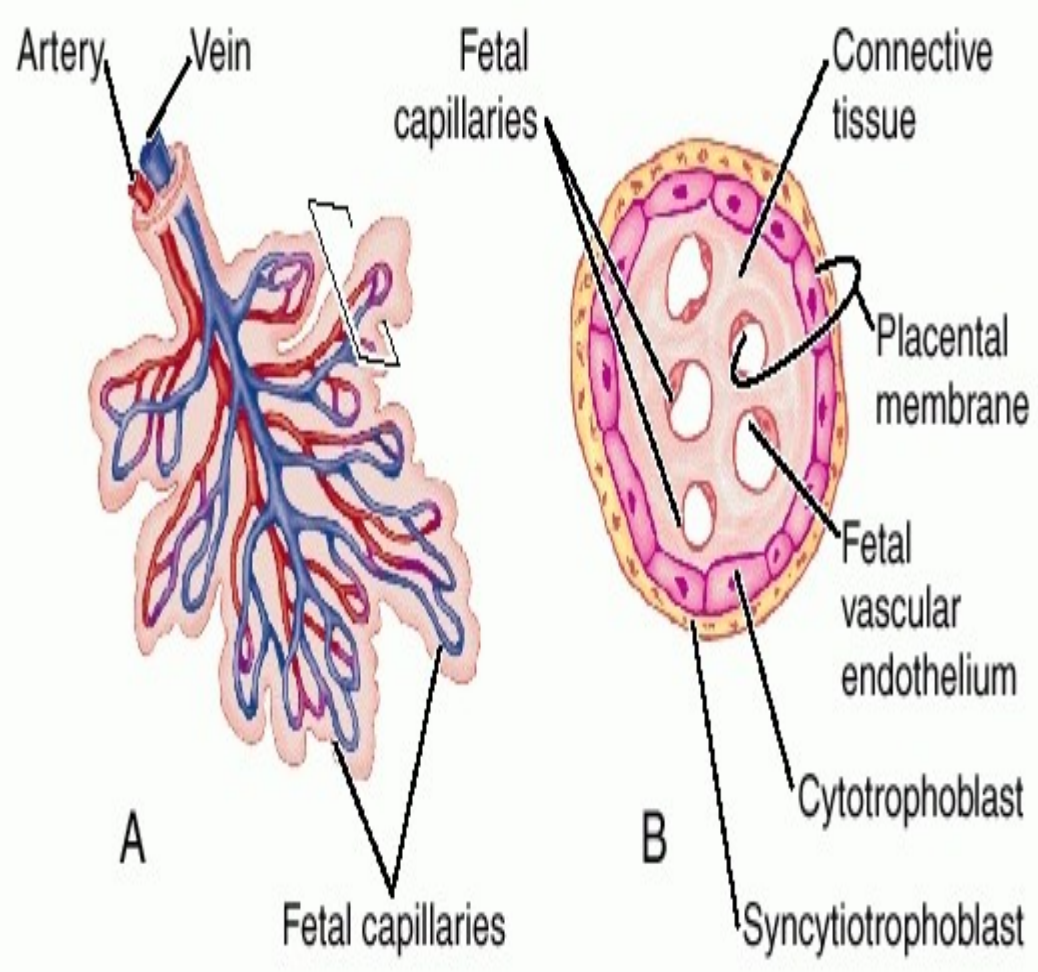
5- B.M. of the endothelium.

6- Continuous endothelial cells of the fetal bl.

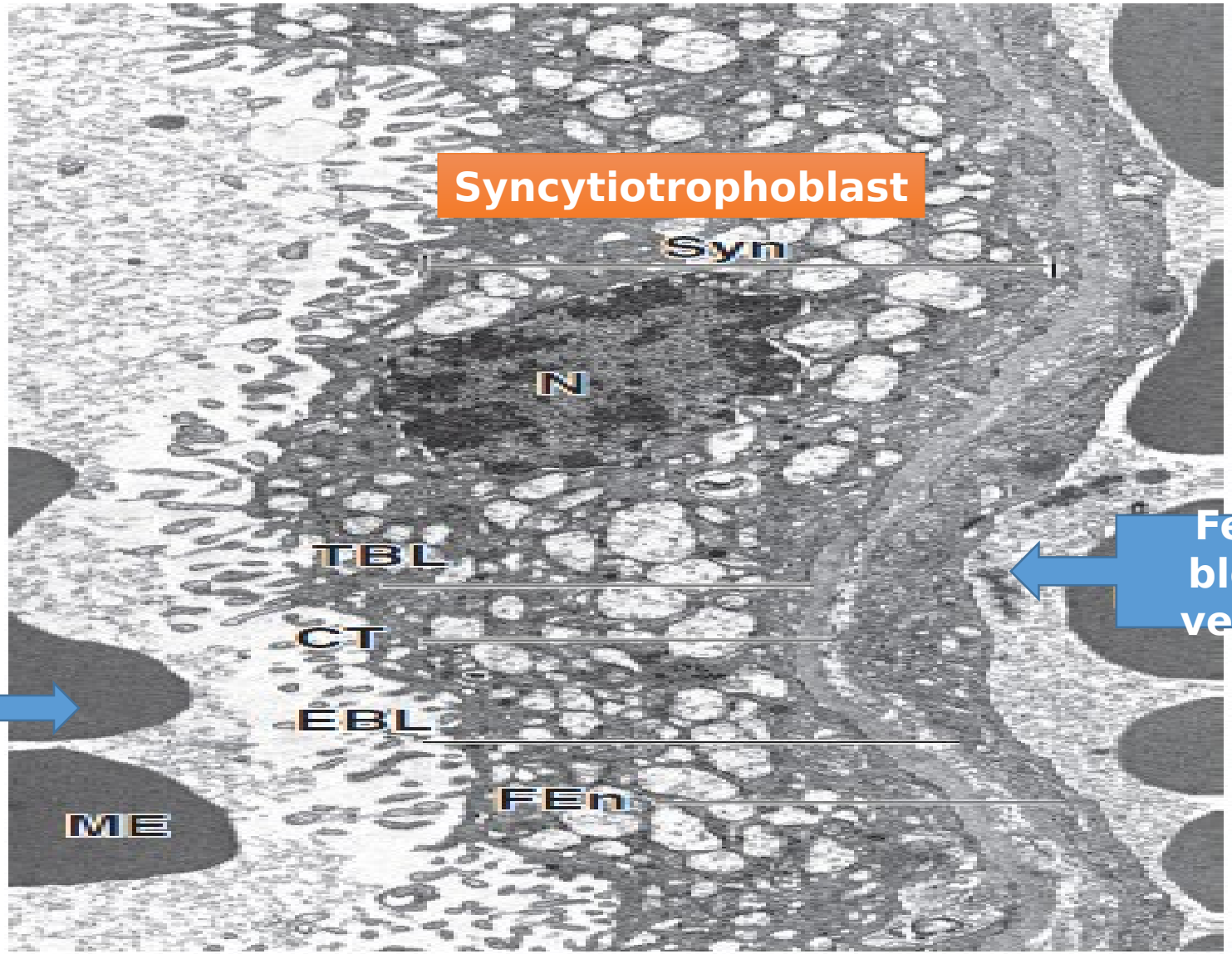
Function:

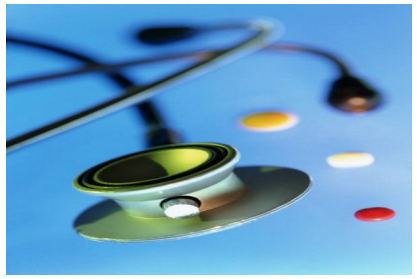
- Prevent passage of harmful substances as drugs, toxins antigens.

- Nutritive substances, hormones & antibodies can selectively pass to the fetus.

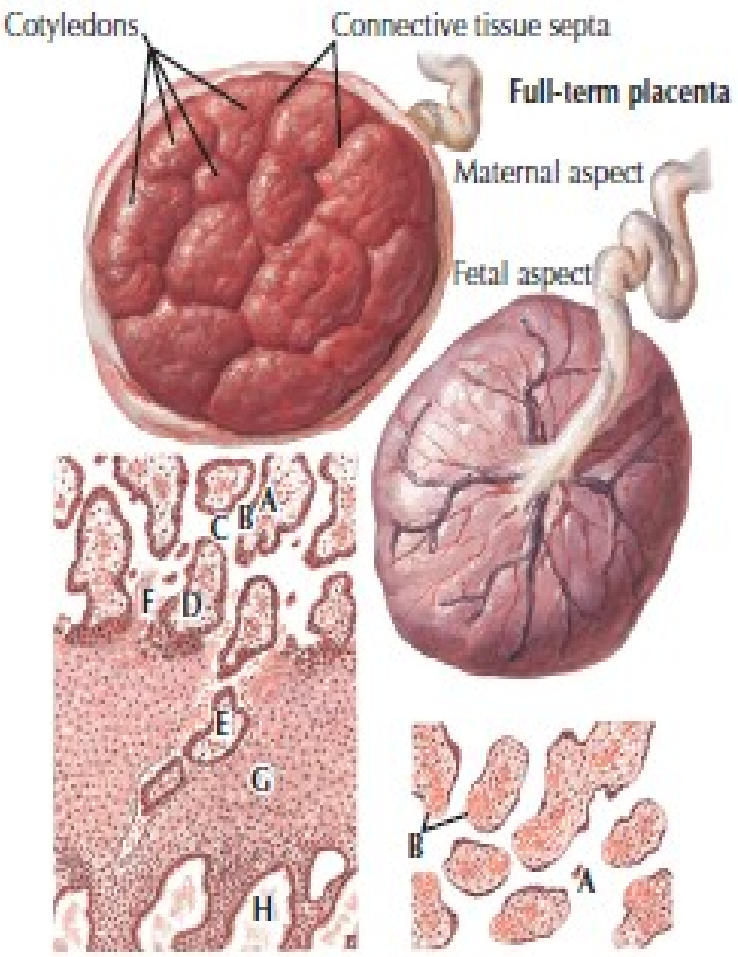


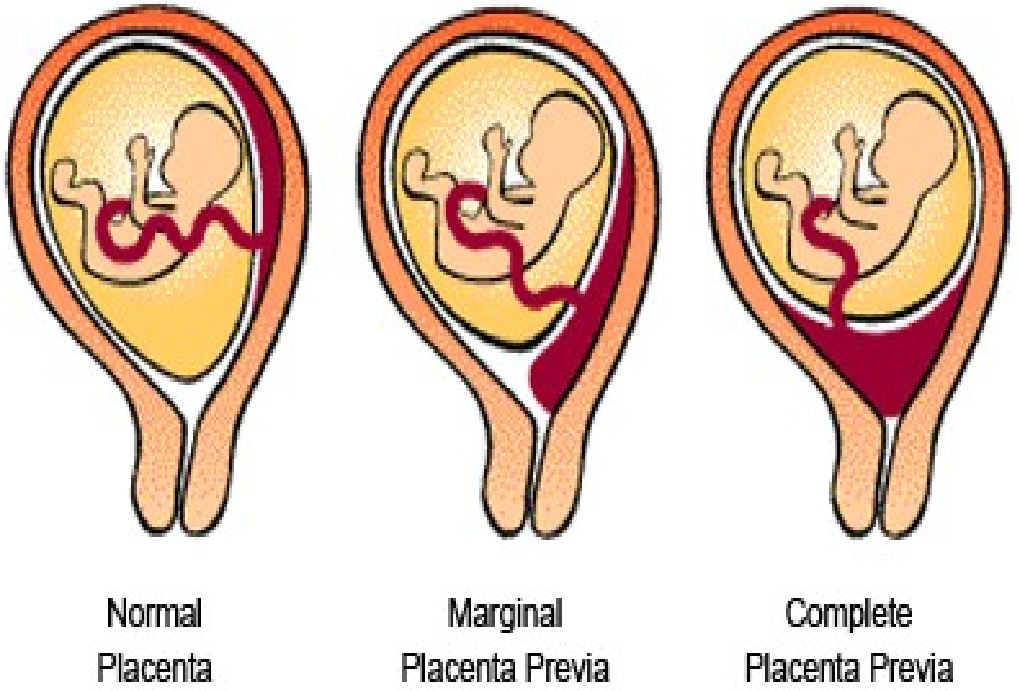
Placental barrier in 3rd trimester of pregnancy (TEM)



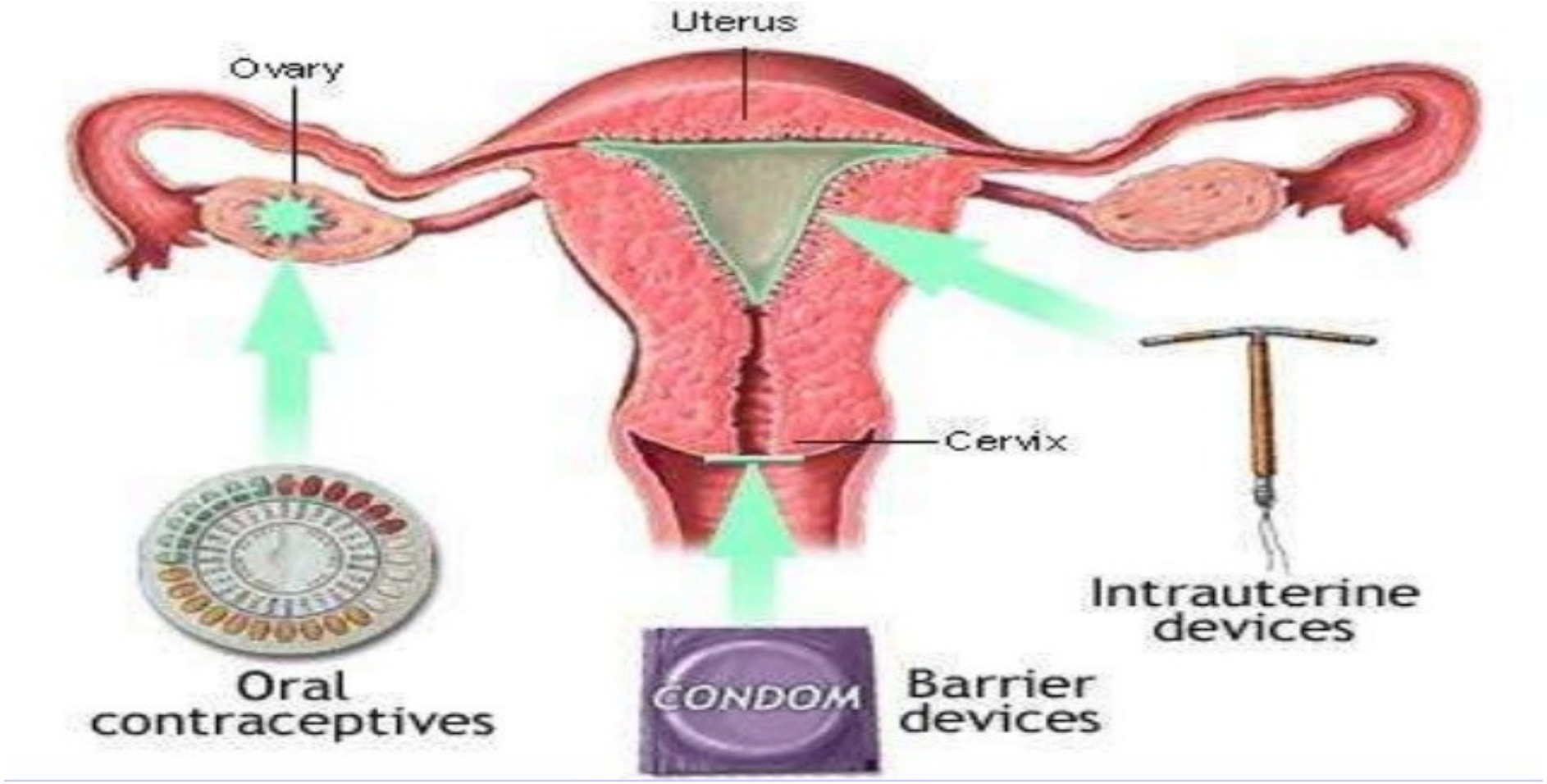


Clinical Correlation
Placenta previa





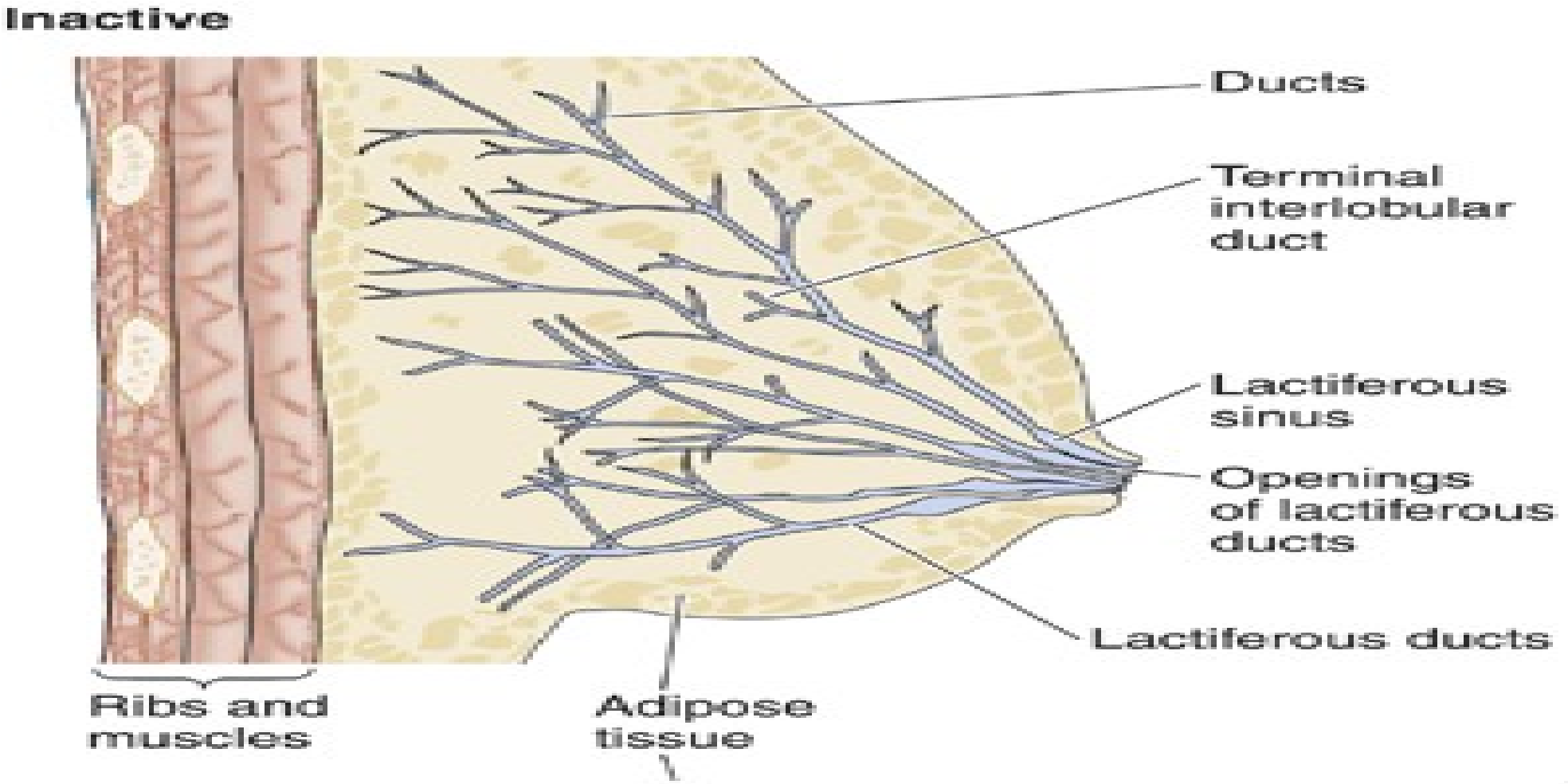
Clinical Correlation
Contraception



MAMMARY GLAND

- **Each mammary gland is formed of 15-25 lobes of the compound tubulo-alveolar type.**
- **Each lobe empties through a lactiferous duct which exhibits a terminal expansion called a lactiferous sinus.**
- **The mammary gland is covered by thin skin which includes nipple and areola.**
- **The histological structure varies according to age, menstrual cycle and reproductive status of the female.**

Resting mammary gland



1-Resting mammary gland

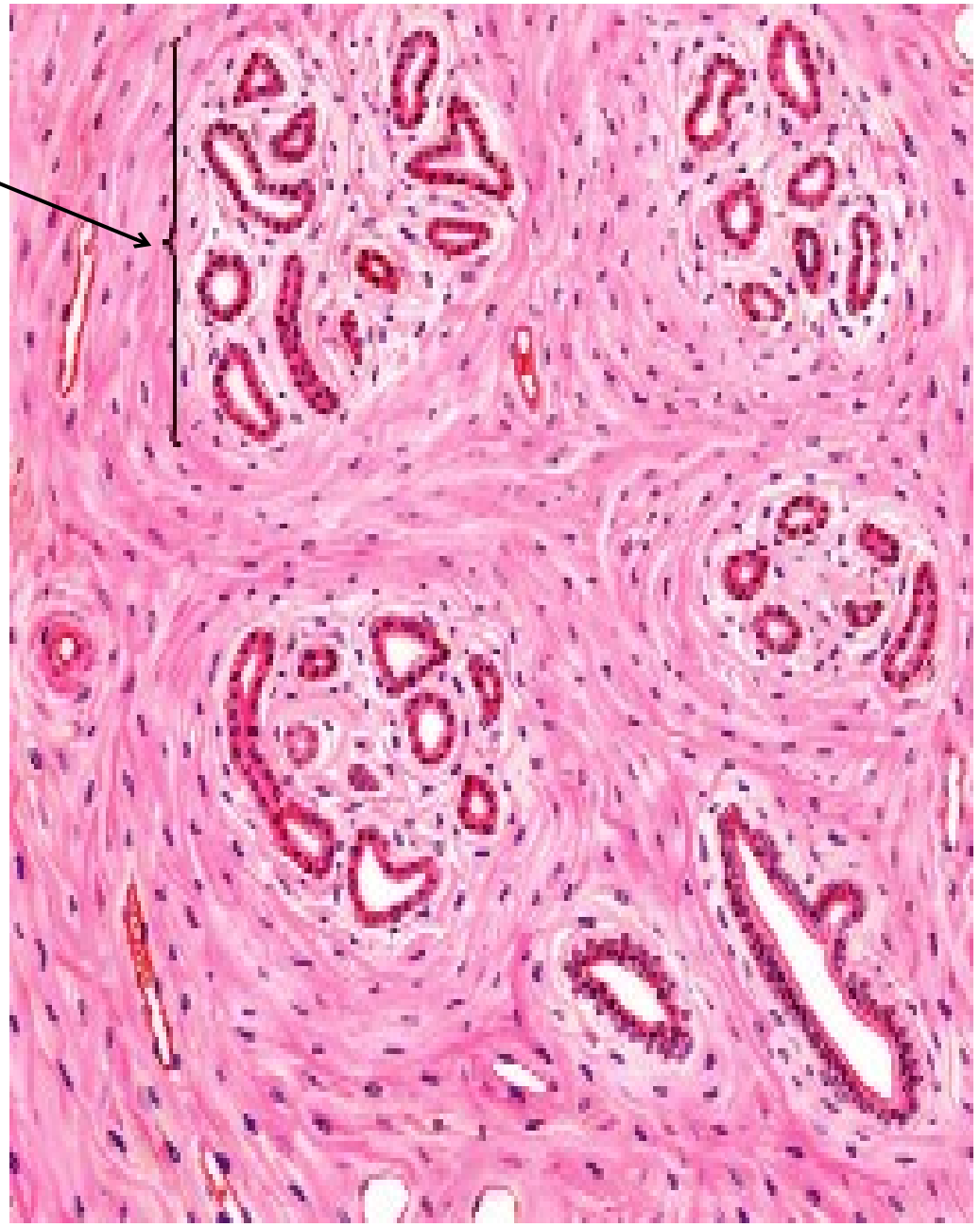
Histological structure:

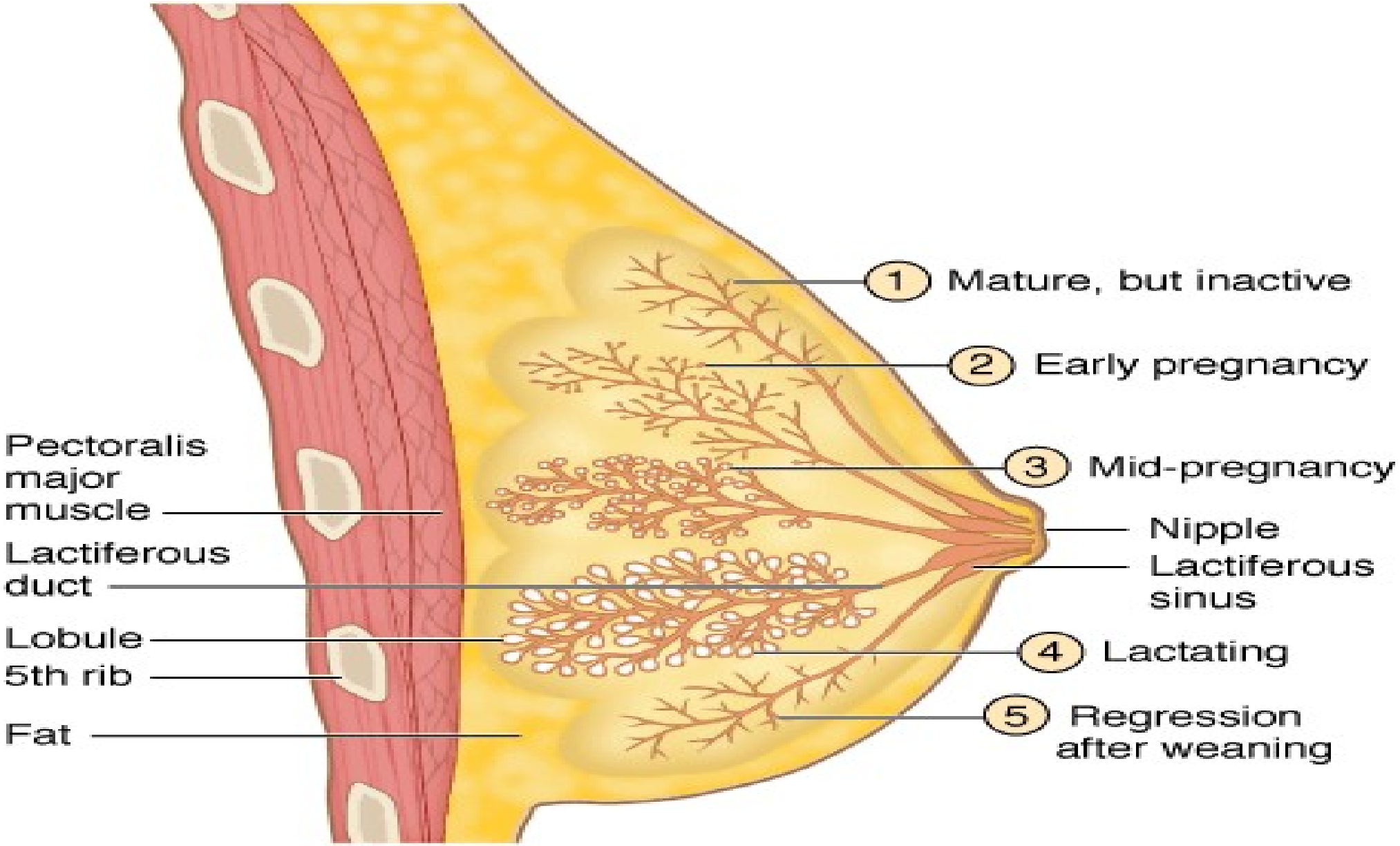
I- C.T. stroma

- **The stroma develops from the dermis of the skin present under the region of the nipple ---> *act as a capsule***
- **Inter-lobar septa: dividing mammary glands into 15- 25 lobes.**
- **Inter-lobular septa.**
- **Adipose C.T.**

II- Parenchyma:

- **Is represented by duct system only with no secretory alveoli.**
- **Intralobular & interlobular ducts: lined with→*st. cuboidal epith.* ,surrounded by myoepithelial cells.**
- **Lactiferous duct (*st. cuboidal epith.)*→ drain each lobe**
- **Lactiferous sinus lined with *st. sq. epith.* → external orifice on the nipple.**




1 Mature, but inactive
2 Early pregnancy
3 Mid-pregnancy
Nipple
Lactiferous sinus
4 Lactating
5 Regression after weaning
Pectoralis major muscle
Lactiferous duct
Lobule
5th rib
Fat

Cyclic changes of mammary glands

- **During the follicular phase:**

  Estrogen → proliferation of the duct epithelium

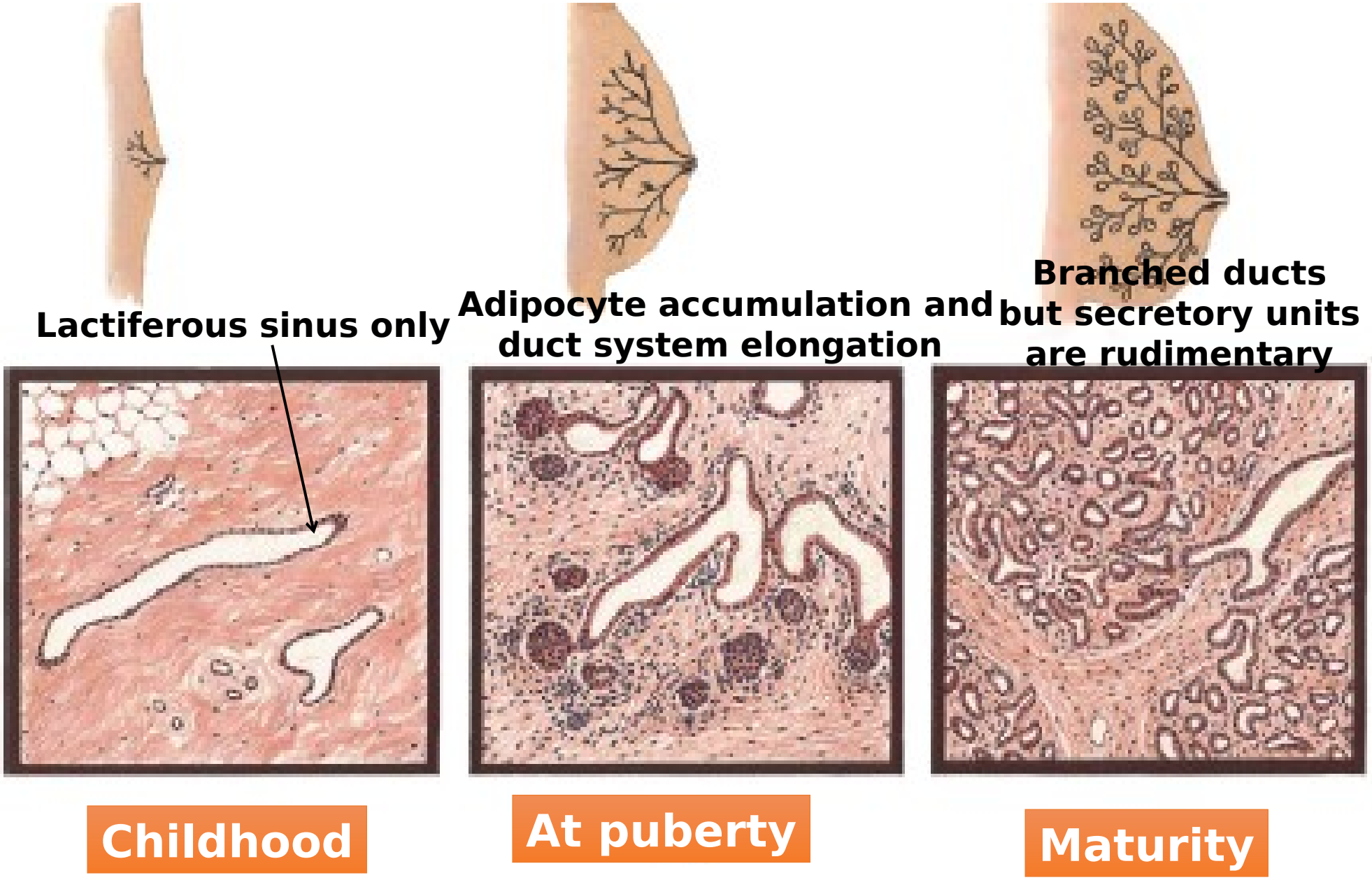
- **During luteal phase :**

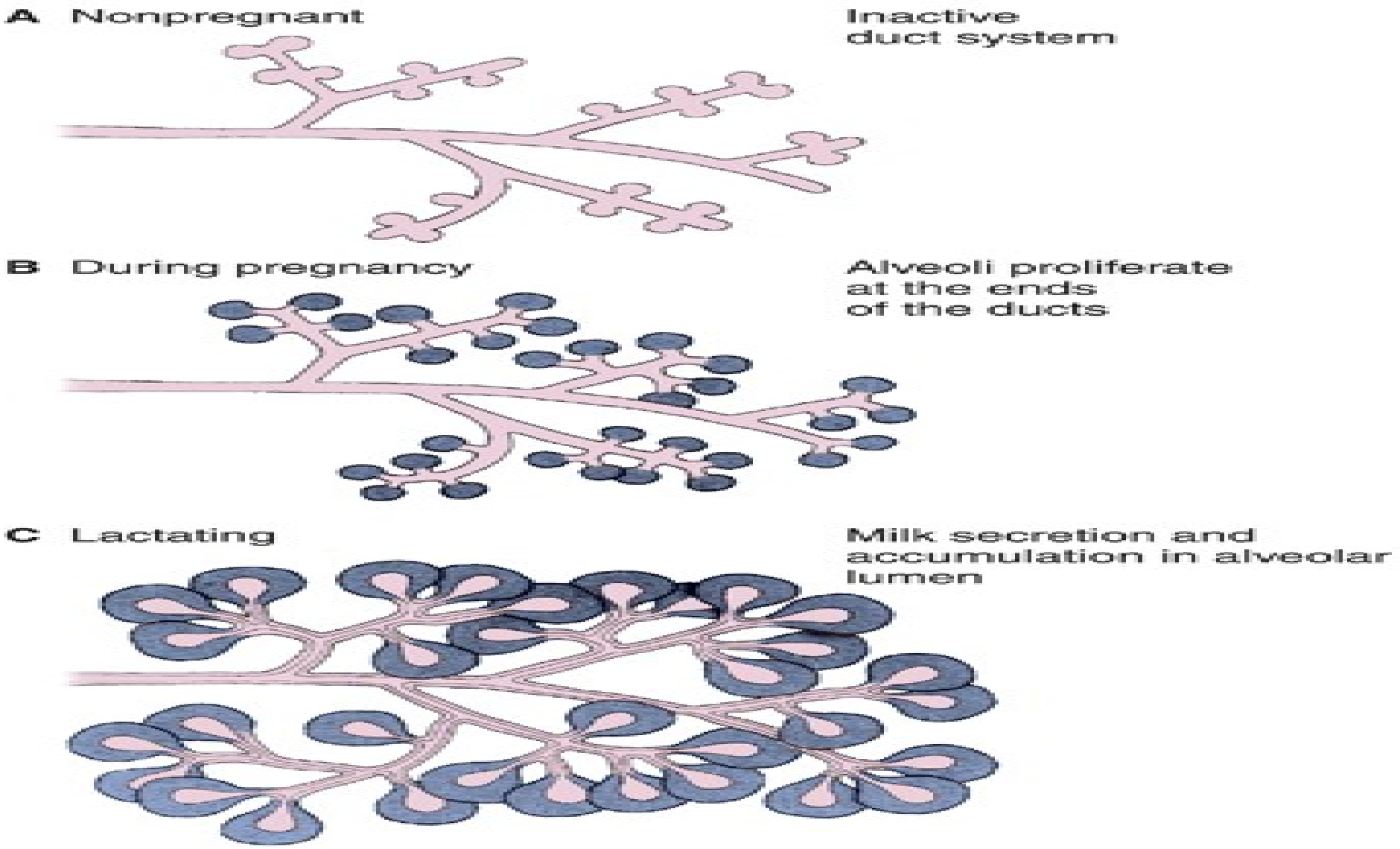
  Progesterone →

1- Small amount of secretions accumulate in duct lumen

2- Intralobular stromal edema (because this loose C.T is hormonally sensitive)→causes tenderness and fullness of mammary glands.

✓**This followed by abrupt involution and apoptosis before onset of menstruation.**


Lactiferous sinus only
Adipocyte accumulation and duct system elongation
Branched ducts but secretory units are rudimentary
Childhood
At puberty
Maturity


A Nonpregnant
Inactive duct system
B During pregnancy
Alveoli proliferate at the ends of the ducts
C Lactating
Milk secretion and accumulation in alveolar lumen

2- Changes during pregnancy

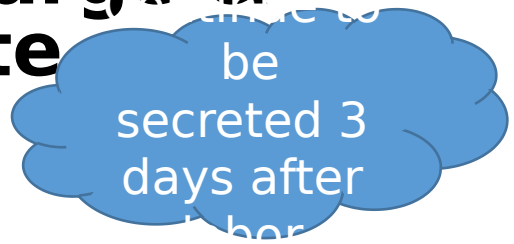
***During 1st half of pregnancy*:**

1. **The duct system → rapid proliferation, branch → forms buds → enlarge into alveoli.**

2. **↓ amount of fat & C.T.**

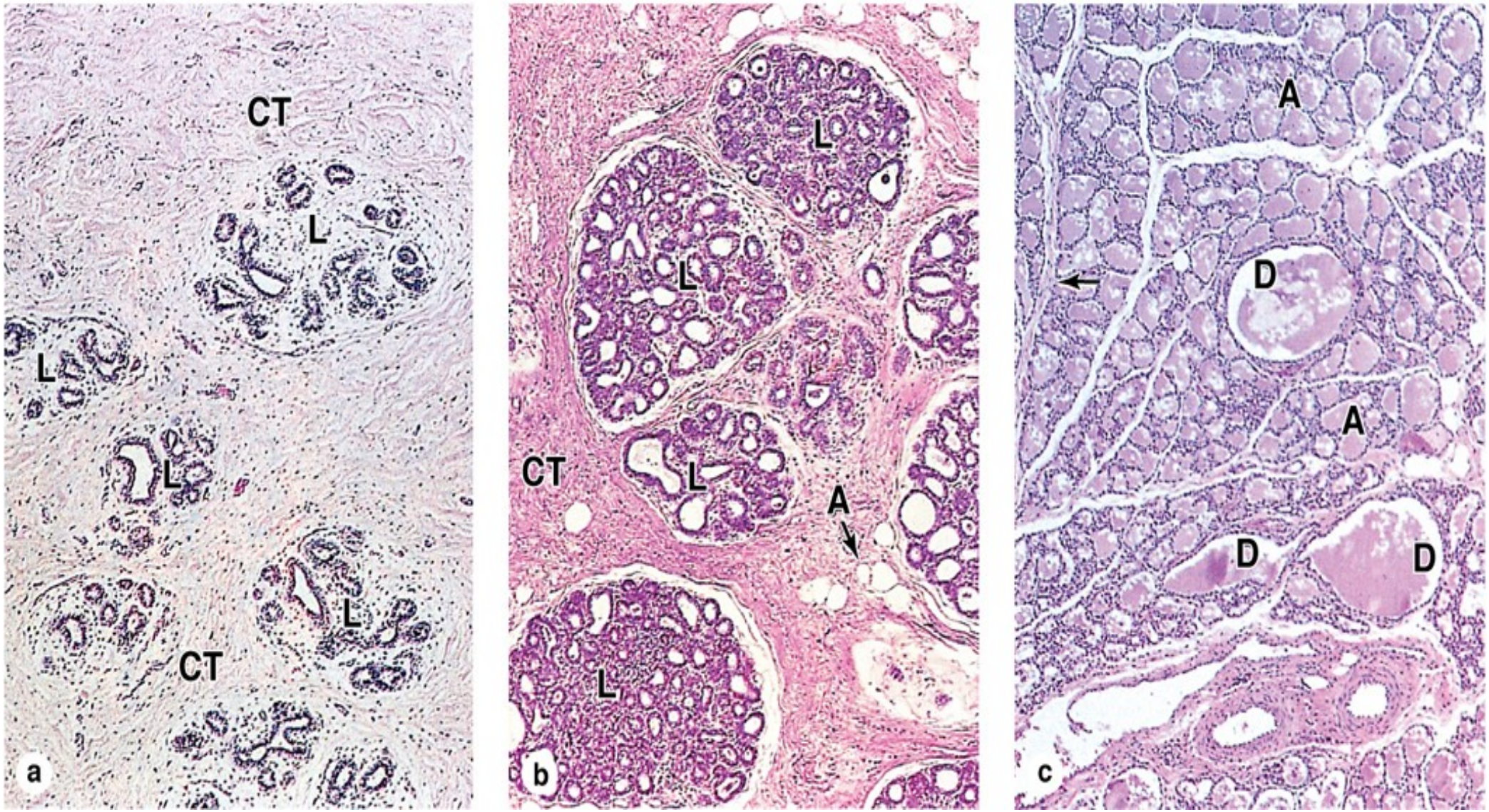
***During 2nd half of pregnancy*:**

- **The alveoli enlarge & begin to secrete**



- **At the end of pregnancy watery fluid called → *colostrum :***

1. **Rich in protein , lactose & IgA**
2. **Less fat.**



Resting

During Pregnancy

Lactating

3-Lactating mammary gland

- Stroma:

- **As in resting mammary but C.T. septa are very thin & amount of adipose tissue is much reduced.**
- Lymphocytes and plasma cells are located in the connective tissue surrounding the alveoli.
- The plasma cell population increases significantly at the end of pregnancy and is responsible for the secretion of **IgA** that confers passive immunity on the newborn.

- Parenchyma:

1- Secretory alveoli

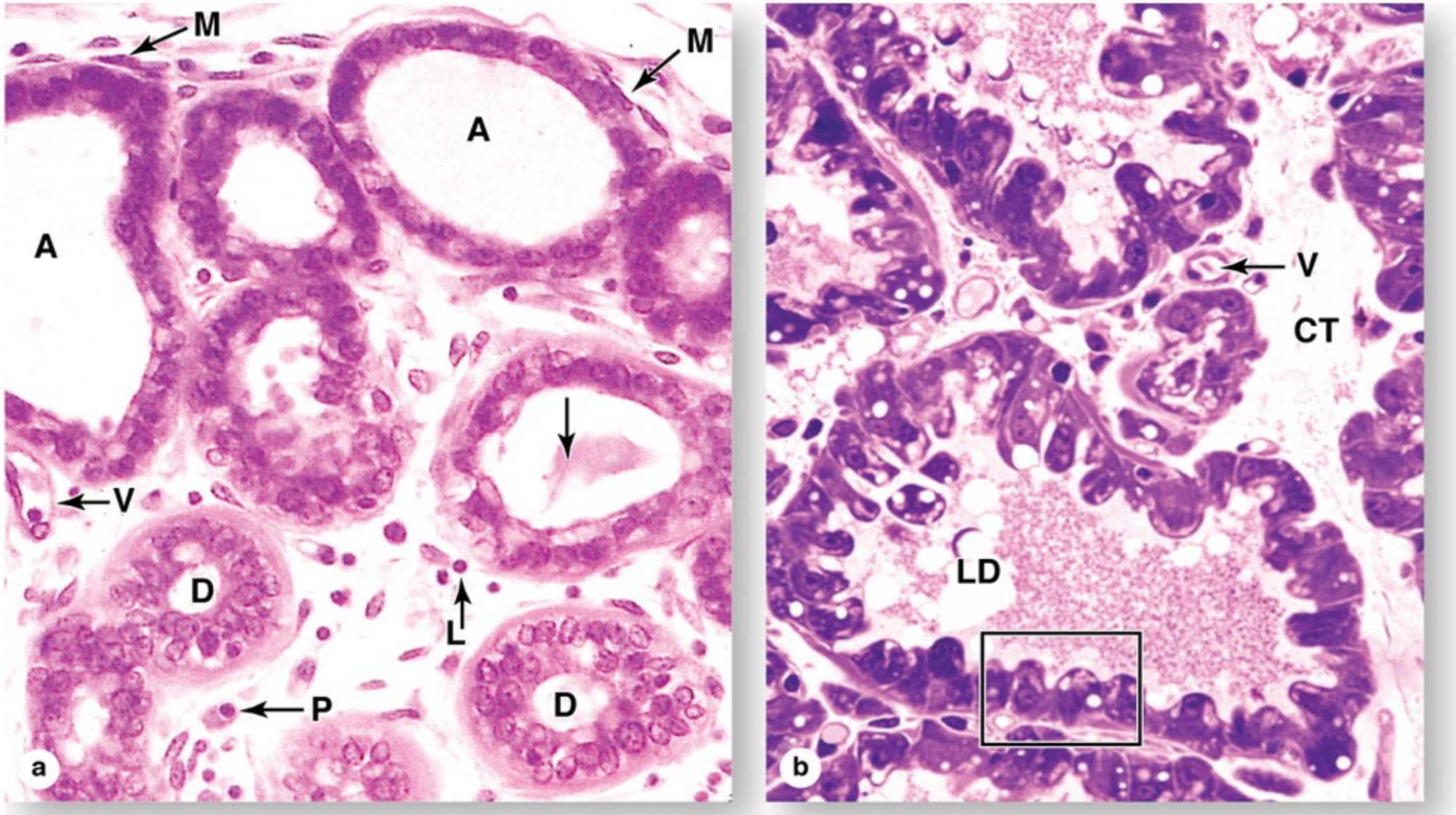
2- Ducts

Parenchyma:

A- Secretory alveoli:

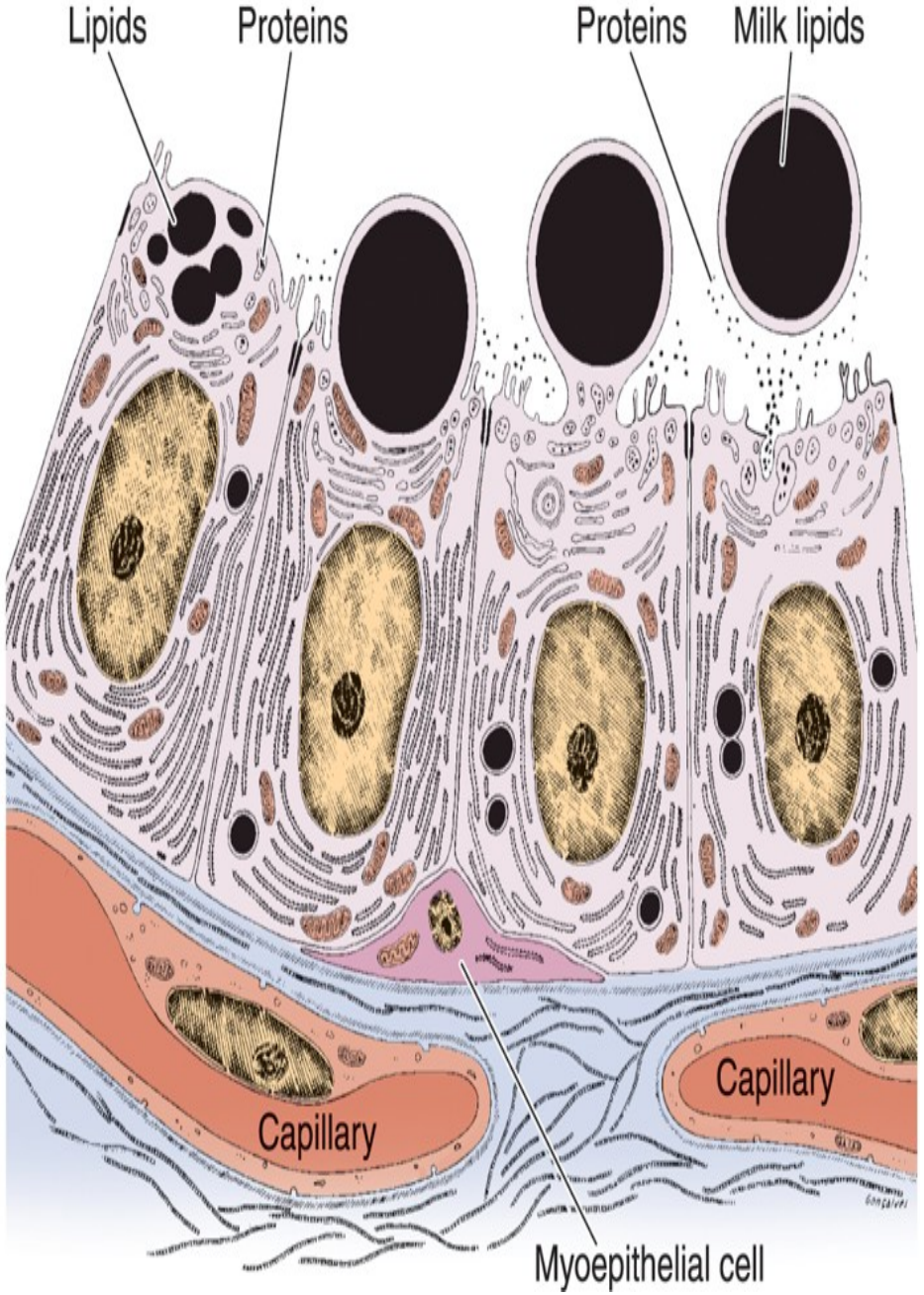
With LM:

- Some alveoli are distended with milk others are empty.
- The milk appears within alveoli vacuolated due to dissolved fat.
- The lining epithelium varies from tall columnar to cuboidal depending on state of activity.
- Basophilic cytoplasm and central, rounded, vesicular nucleus.
- Myoepithelial cells are found between epithelial cells and basal lamina.


M
M
A
A
V
D
L
P
D
a
V
CT
LD
b

With EM:

- **Cells show all features of protein secreting cells.**
- **Secretion of milk is partly merocrine (protein) & partly apocrine (fat).**



B-Duct system:

- **These ducts proliferate and form new branches.**

Hormonal control:

- **After labour, prolactin →stimulate alveolar cells to secret milk.**
- **Suckling, oxytocin →stimulate contraction of myoepithelial cells →ejection of milk (milk ejection reflex).**
- **After cessation of lactation (weaning), the parenchyma involutes, the structure of inactive gland is reassumed.**

CLINICAL CORRELATION
BREAST CANCER

- **One of the major cancers in women.**
- **Types:**

1- Ductal carcinoma→ interlobular ducts

2- Lobular carcinoma→ lobular terminal ductules

- **Early detection through** Self examination mammography

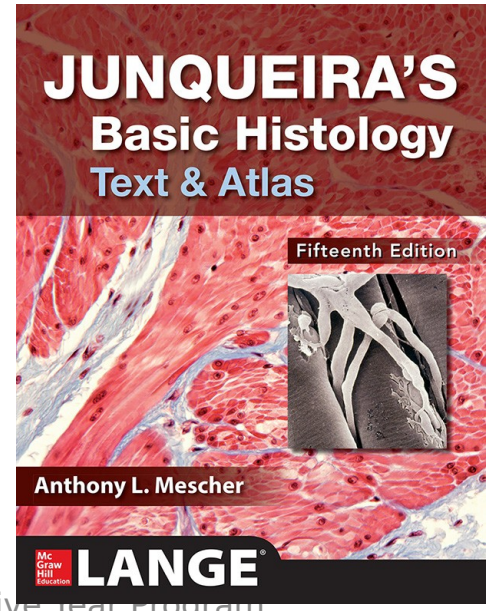
- **Complications:**
- **Metastases to the axillary lymph node.**

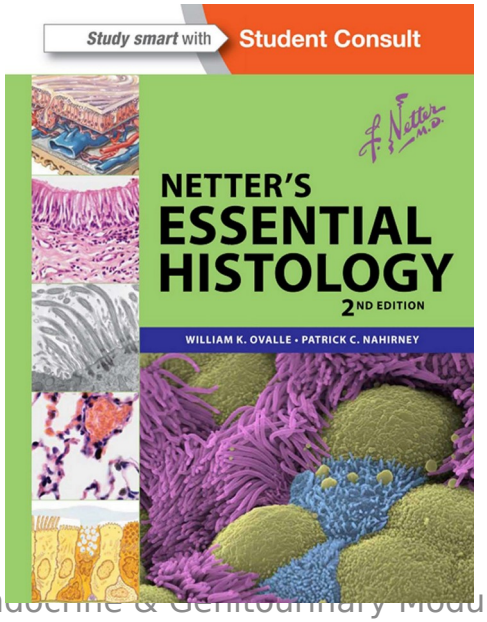
Activity

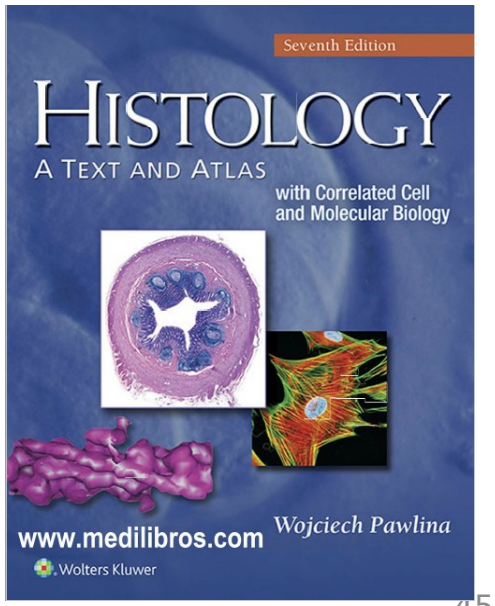
What do you think about causes of female infertility?

SUGGESTED TEXTBOOKS

1. Junqueira's Basic Histology: Text and Atlas, 15th Edition by Anthony Mescher , 2018.
2. Michael H. Ross, Histology text and Atlas with correlated cell and molecular biology, 7th Edition, 2015.
3. Netter's Essential Histology, 2nd edition, 2013.








Thank You